

tions of the solar physics observatory, the magnetic observatory, the balloon and kite plant, and should be operated as a unit, because the cosmical problem has branches in each of these realms of physics, and they can not be separated without injuring the progress that is to be expected from their cooperation. The primary policy of this investigation is to be determined by the fact that the energy effective in producing weather of short periods and climate of long periods, consists of solar terms and terrestrial terms, which are very closely interwoven, but must be separated from each other. In the process of disentangling the solar and terrestrial terms, respectively, the functions connecting the several phenomena, or the physical relations between them, must be carefully studied. At present the entire subject is in confusion, and no deliberate attempt can be made to work up the relative values of the several forces until the observations of the several kinds are placed side by side for comparison. The establishment of suitable series of homogeneous observations in the several branches is the first work of such an observatory. We have so recently become convinced that there is a genuine solar-terrestrial problem for the meteorologist to investigate, that but little definite has been done in putting such a comparative work in operation.

The numerous contributions to the general subject from all

portions of the world are absolutely bewildering in their complexity, and we can not expect to make any serious advances unless the details of such observations can be classified in one far-reaching, comprehensive scheme. The observatory must be organized like an army, with a general supported by officers who will execute the several parts of the operations required in the plan of campaign. I shall attempt merely to enumerate, in the next paper, the instrumental methods that it is proposed to employ at Mount Weather, so far as experience shall prove them to be practicable. Every stage of the instrumental work, and that of the reduction of the observations, will imply that first-class training is required, and of course the actual success of the enterprise will depend almost entirely upon the number of expert scientists that can be procured for such a service. As stated above, the margin is not large upon which we can do the solar work, owing to the diminished effects at the earth of the sun's variations, due to its great distance from the earth, and we must waste nothing by using bad methods of work and unskilled men, if any profitable result is to be secured. Poor workmanship and untrained men are barred by reason of the rigorous scientific demands that are placed upon these operations by the natural physical conditions which prevail in cosmical meteorology.

NOTES AND EXTRACTS.

KITE WORK IN THE ATLANTIC TRADE WIND REGION.

Under date of September 7, 1905, Prof. Dr. H. Hergesell writes that he has just returned from a scientific expedition for the exploration of the upper atmosphere over the Atlantic Ocean, and adds:

I have just received the MONTHLY WEATHER REVIEW for May, and find on page 209 an interesting communication from Mr. Rotch. In one place he says: 'The trade winds and doldrums will thus be traversed and it is hoped that the meteorological conditions prevailing above them, which are practically unknown, will be at least partially revealed.'

From this it would appear as though in general no kite ascensions had been made in the trade wind regions, whereas in the region between Gibraltar, the Canaries, and the Azores, at my request, a series of kite ascensions have been made by the Prince of Monaco, extending up to an altitude of 4500 meters. I have published the results in the *Comptes Rendus* of the Academy of Science of Paris, and I send a copy herewith and pray that if possible you will publish at least a summary in your periodical.

In the spring of 1904 the Prince of Monaco undertook to devote his private yacht to the study of the meteorological conditions prevailing in the atmosphere above the ocean. Prof. Dr. H. Hergesell was associated with him in this work. Hargrave kites were used having respectively 3 and 5.7 square meters of surface. The kite lines were steel wire of 0.7 and 1.0 millimeter diameter. Eight kite ascensions were made above the Mediterranean between April 12 and 24, 1904, at the beginning of the cruise, sixteen above the Atlantic, and one above the Baltic. The maximum altitude of 4510 meters was attained on the 9th of August to the northwest of the Canaries and a nearly equal altitude of 4360 meters on the 28th of August to the south of the Azores. Many other ascensions exceeded 2000 meters. The ascensions above the Mediterranean gave this general result, that at the free surface of the water there is a very rapid diminution of temperature and that the wind diminished very much with altitude. However, on the coast of Corsica with a southeast wind we found a warm current blowing from Corsica and the temperature increased with altitude, while at the same time the humidity diminished; at an altitude of a few hundred meters there was a calm. These exceptional conditions seem to be due to the influence of the neighboring coast.

The ascensions made over the Atlantic Ocean had for their special object the exploration of meteorological conditions in the trade wind region. They began July 19, 1904, on the Portuguese coast opposite Oporto. The yacht sailed toward the Canaries which were doubled and then toward the Azores whence it returned to the Mediterranean. Throughout the whole region we made kite ascensions at convenient intervals, the last one being on September 20, 1904, with the following principal results:

We found the trade wind blowing from the northeast in the latitude of Oporto at an altitude of 400 meters, but at the level of the sea the

wind was northwest. Beginning with the latitude of Lisbon the trades were also observed in the lowest stratum as a feeble wind from the northeast. In proportion as we advanced toward the Canaries this northeast wind increased in force. From 35° north to the Canaries we observed a steady wind of seven meters per second. Farther south the velocities attained even nineteen meters per second, but only in the neighborhood of the islands. The results of all the ascensions made in this trade wind region were sufficiently concordant to permit of the following résumé:

In the lower layers of air there is a strong diminution of temperature with altitude; the adiabatic gradient 1° per 100 meters is always attained. In the lowest stratum it is even exceeded. The thickness of this adiabatic layer varies between a 100 and 600 meters. The relative humidity which is 70 or 80 per cent at sea level increases gradually to 95 or 100 within this stratum. At the upper limit of the layer there is a sudden change, the temperature suddenly rises many degrees and the humidity suddenly diminishes to values lower than 50 per cent. After this sudden change there comes a layer of inversion or of mixture that attains sometimes a thickness of 1000 meters where the temperature continues to rise and where the humidity diminishes to 10 or 20 per cent. In this layer sometimes at an altitude of 1000 meters we find temperatures as high as 30° C., while at sea level we have only 22° or 23° C. Above the layer of mixture we find again a layer having an exactly adiabatic gradient, but in which the humidity is small, contrary to the conditions in the first adiabatic layer. However, the relative humidity increases with altitude in such a way that the hygrometric richness¹ remains constant. This permits us to conclude that the current must be descending and I will call this zone the layer of antitrade. According to our observations it attains an altitude of at least 4500 meters and probably extends much higher.

It has been possible to determine the direction of the wind at different altitudes and even to measure the velocity by both direct and indirect methods. In the first adiabatic layer we find a trade wind from the northeast of about seven meters per second. As the height increases the wind gradually backs more frequently from north to northwest, but in two cases veered from northeast through east to southeast and south. At the inversion altitude, that is to say about 600 meters, the direction changes sometimes suddenly, and the force diminishes considerably. The layer of the trade, properly so-called, is therefore quite shallow. A current from the southwest that should correspond to the theoretical antitrade has never yet been found by kite ascensions, although these have oftentimes exceeded the altitude of the peak of Teneriffe. Many corroborating circumstances have forced me to think that the southwest winds (antitrades) observed on the peak of Teneriffe by many observers have a local origin and are due to the influence of the island.

¹ The *richesse hygrométrique* or hygrometric richness is a term introduced into French meteorology by Jamin about 1880, it is a ratio computed by dividing the actual vapor tension by the barometric pressure less the vapor tension, and multiplying by the constant 0.623. In other words it is the ratio of the weight of the vapor to the weight of the dry air and is very nearly identical with the so-called specific humidity which is the weight of the vapor contained in a kilogram of moist air.—[ED.]

The northwest and southeast winds observed by us in the more elevated layers had at the most a velocity of three or four meters per second. The velocity was generally smaller in the intermediate layers over the regions that we have explored, the air in the antitrade blew especially from the northwest and the direction of the northeast trade changed with increasing altitude into north and stopped at northwest. Once we observed cirrus coming from the southwest and on that same day the wind turned from northeast to south as the altitude increased. We have often observed the trade cumuli or rolls of flat clouds stretched out in the direction of the wind. These always form in the upper part of the first adiabatic layer and therefore at an altitude of only a few hundreds of meters. The hygrometric diagrams demonstrate that there are ascending currents whose upper limit is given by the altitude of the layer of inversion where these clouds (trade cumuli?) are dissolved. When the layer of inversion has descended sufficiently low so that the ascending currents can not cool to the point of condensation they do not form cumuli. On the contrary when the cumuli do form one ought to be able to say in advance that the zone of inversion will be found at a higher level. As an example I give in the following table some of the data that resulted from one ascension:

Ascension on August 9, 1904. Location, west of the Canaries.

Height.	Tem- perature.	Relative humidity.	Direction of wind.
<i>Meters.</i>	<i>° C.</i>	<i>Per cent.</i>	<i>°</i>
0	23.0	80	n. 52 e.
200	20.5	88
400	18.5	88	n. 36 e.
500	18.0	93
600	18.9	80
800	24.5	35
1,000	26.4	36	n. 29 e.
1,200	26.2	16	n. 15 e.
2,000	18.0	21
3,000	9.0	30
4,000	-1.5	40
4,500	-5.6	47	n. 25 w.

In the neighborhood of the Azores we observed winds from the northwest and the distribution of temperature and humidity also had a different character. Immediately above the ocean there existed at all hours of the day a decrease of temperature that was adiabatic or more than adiabatic. We have never observed the nocturnal inversion of temperature that is so common over the continents.

THE IMPARTIAL DISTRIBUTION OF WEATHER-CROP BULLETINS.

Several years ago it became necessary for the Chief of the Weather Bureau to devise some method by which the public might be treated with perfect fairness in the matter of publishing the weekly weather-crop bulletin. It appears that during the growing season farmers, brokers, boards of trade, transportation companies, and newspapers are each anxious to obtain, at the earliest possible moment, the latest news as communicated in these bulletins, striving to anticipate the others by a few minutes if possible, since these few minutes sometimes mean thousands of dollars to a large dealer.

A large edition of the bulletin is printed in the forenoon on Tuesday. The information it contains is known only to the few men concerned in making up the report. As a practical and fair method of distribution the printed copies are given simultaneously at 12 noon, eastern standard time, to all who wish them.

This plan is adhered to up to the present moment, and seems to give perfect satisfaction to all parties. The quick dissemination of the news throughout the country is therefore no longer the duty of the Weather Bureau, but of those who come to the Bureau for the weekly bulletins. By proper arrangement between the boards of trade, interested individuals, the newspapers, the Associated Press, other press associations, and the telegraph companies, two or more telegraph operators appear at the Weather Bureau promptly at noon Tuesday, take their copies of the printed bulletins and immediately repair to the nearest telegraph line outside the grounds of the Bureau, where they "cut in" with their portable transmitters and send the bulletin throughout the country.

The Postal Telegraph Company has a permanent station at a drug store a thousand feet away; the accompanying photograph, fig. 1, shows the Western Union operators sitting on the ground absorbed in their work, which is completed in a few minutes.